WHAT WE CLAIM IS:

- A method of sampling internet protocol traffic over links of an internet 1
- protocol network comprising the steps of 2
- sampling packets at network traffic points as a function of an internet 3
- 4 protocol packet content, and
- 5 generating a packet label for each sampled packet.
- A method as recited in claim 1 wherein said function of an internet 2. 1
- protocol packet content is dependent upon substantially invariant data of said 2
- 3 packet.
- 3. A method as recited in claim 2 wherein said invariant data of said packet 1
- includes at least high entropy data fields 2
- A method as recited in claim 2 wherein said invariant data excludes at 4. 1
- 2 least variable fields.
- A method as recited in claim 3 wherein said invariant data further excludes 5. 1
- at least one of a service type field, a header checksum, a version field, and a 2
- header length field. 3
- 6. A method as recited in claim 2 wherein said invariant data further includes 1
- a low entropy data field. 2
- 7. A method as recited in claim 1 wherein said packet label has a length 1
- determined to be as small as possible consistent with avoiding a collision with a 2
- similarly labeled packet during the expected period a sampled packet takes to 3
- traverse the network. 4
- A method as recited in claim 1 wherein said applied packet label 8. 1
- 2 comprises between 16 and 24 bits.

IDS No.: 2000-0065

- 9. A method as recited in claim 1 wherein a sampling interval for a given
- 2 period is determined by the upper bound of a sampled packet's expected lifetime.
- 1 10. A method as recited in claim 1 further comprising the step of transmitting
- 2 said generated label to a measurement system.
- 1 11. A method as recited in claim 10 further comprising the step of multiplying
- the number of packet samples and the number of bits per sampled packet at a
- 3 measurement system.
- 1 12. Circuit apparatus for sampling internet protocol traffic over links of an
- 2 internet protocol network for use in sampling traffic at network traffic points
- 3 comprising
- a processor for computing a sampling function, responsive to the sampling
- 5 function, for determining packets to be sampled, and for generating a label for
- 6 each sampled packet.
- 1 13. Apparatus as recited in claim 12 further comprising a packet buffer for
- 2 temporarily holding packets during sampling.
- 1 14. Apparatus as recited in claim 12 providing an output to a measurement
- 2 system of labels for only sampled packets.
- 1 15. Apparatus as recited in claim 12 wherein said sampling function of an
- 2 internet protocol packet content is dependent upon substantially invariant data of
- 3 said packet.
- 1 16. Apparatus as recited in claim 15 wherein said invariant data of said packet
- 2 includes an invariant data field.

IDS No.: 2000-0065

- 1 17. Apparatus as recited in claim 15 wherein said invariant data excludes a
- 2 variable data field.
- 1 18. Apparatus as recited in claim 15 wherein said invariant data further
- 2 excludes at least one of a service type field, a header checksum, a version field,
- 3 and a header length field.
- 1 19. Apparatus as recited in claim 15 wherein said invariant data further
- 2 includes a low entropy data field
- 1 20. Apparatus as recited in claim 12 wherein said packet label has a length
- determined to be as small as possible to avoid collisions with packets having a
- similar label within the expected period a sampled packet takes to traverse the
- 4 network.
- 1 21. Apparatus as recited in claim 12 wherein said applied packet label
- 2 comprises between 16 and 24 bits)
- 1 22. Apparatus as recited in claim\12, said processor for determining a
- 2 sampling interval by the upper bound of a sampled packet's expected lifetime.
- 1 23. Apparatus as recited in claim 12 further comprising a data transmitter for
- transmitting a plurality of labels and data to a measurement system as an IP
- 3 packet.
- 1 24. Apparatus as recited in claim 1/2 said processor for multiplying the number
- 2 of packet samples and the number of bits per sampled packet.
- 1 25. Apparatus for sampling sw/tched packet traffic over links of a packet
- 2 switching network for use in sampling traffic at network traffic points comprising
- an input buffer for temporarily storing incoming data packets during
- 4 sampling and

a sampling subsystem for determining which packets to sample and

40

- 6 generating labels for each sampled packet.
- 1 26. Apparatus as recited in claim 25 wherein a sampling function and a
- 2 labeling function operate in parallel.
- 1 27. Apparatus as recited in claim 25 for use at an ingress router, the apparatus
- 2 further comprising a data transmitter for transmitting said generated label and
- 3 packet parameters to a measurement system.
- 1 28. Apparatus as recited in claim 27 wherein said packet parameters comprise
- a source address, a destination address and a length
- 1 29. Apparatus as recited in claim 25 for use at intermediate and egress routers,
- 2 the apparatus further comprising a data transmitter for transmitting said generated
- 3 label to a measurement system
- 1 30. Apparatus as recited in claim 29 wherein said data transmitter further
- 2 transmits a time stamp to said measurement system.
- 1 31. Apparatus as recited in claim 25 further comprising a packet constructer
- 2 for constructing probe packets comprising predetermined invariant data.
- 1 32. A method of sampling switched packet traffic over links of a packet
- 2 switching network for use in sampling traffic at network traffic points comprising
- 3 selecting packets for sampling in accordance with a predetermine sampling
- 4 function at an edge router,
- 5 altering a predetermined bit position of a packet that is at least practically
- 6 invariant as a sampling flag to demark a packet selected for sampling.
- 1 33. A method as recited in claim 32 wherein said altered bit comprises a bit of
- 2 a protocol version field.

A method of generating a label-for a packet comprising the step of

- determining a hashing function to generate a practically unique label for a packet 2
- selected for sampling so that said selected packet for sampling will not collide 3
- with another similarly labeled packet at an expected packet rate within an 4
- expected period of life of said packet selected for sampling. 5